

INSTRUCTION MANUAL  
for  
GRAFLEX  
CAMERAS



*RB Super D • RB Series B*

ALSO EARLIER MODELS INCLUDING

*Series B • RB Series D*

*Auto • RB Auto • Auto Jr.*

*RB Tele • RB Jr.*

GRAFLEX, Inc.  
ROCHESTER 8, N. Y., U. S. A.

# TABLE OF CONTENTS

## Principles of the Graflex

Graflex Photography . . . . .	3
Opening and Closing the Graflex . . . . .	5-6
Holding the Graflex . . . . .	6
Focusing . . . . .	7
Automatic Diaphragm . . . . .	7
Interchanging Lenses . . . . .	8
The Focal Plane-Shutter . . . . .	9
Making an Instantaneous Exposure . . . . .	11
Making a Time Exposure . . . . .	12

## The Camera Back

Revolving Back . . . . .	13
Ground Glass . . . . .	14
Focusing Panel . . . . .	14
Film and Plate Attachments . . . . .	14
Loading Holders . . . . .	15

## Lenses

Aperture . . . . .	16
Focal Length . . . . .	17
Long-Focus and Telephoto Lenses . . . . .	18
Wide-Angle Lenses . . . . .	18
Coated Lenses . . . . .	18
Depth of Field . . . . .	19

## Using the Graflex Cameras

Exposure . . . . .	20
Stopping Motion . . . . .	22

## Special Instructions for the RB Auto Graflex

Rising Front and Drop-Bed . . . . .	24
Close-Up Photography . . . . .	24

## Flash Photography . . . . . 25

## Care of the Graflex . . . . . 27

Service, Registration and Serial Numbers . . . . .	29
--	----

## PRINCIPLES OF THE GRAFLEX—*All Models*

Graflex Photography is built around three simple elements:

1. a **reflex viewing-focusing optical system** that shows on a ground-glass an exact, erect image of the scene to be photographed, without parallax and with the same depth of field as the image on the negative;
2. a **multiple-speed focal-plane shutter** giving a wide range of exposures up to 1/1000 with efficiency and reliability; and a
3. **wide selection of sensitized materials** through availability of various types of holders, and a quick, simple, positive means of attaching them to the camera.

The first two elements are interlocked to make operation rapid and simple; the third gives an unlimited choice of emulsions to suit all conditions and types of work.

1. **Reflex focusing** is illustrated in Figure 1. Light enters the camera through the **lens 5** and is reflected upward by the **mirror 3** to the **ground-glass screen 2**; visibility of the image is improved by the light-excluding **focus-hood 1**. The lens is focused by **focusing control 4**. Since the **focus-hood** and the film are equidistant from the lens, sharpness of the image

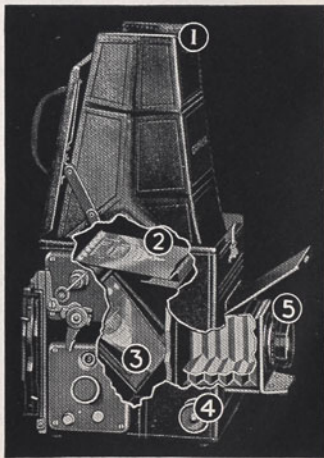


Figure 1

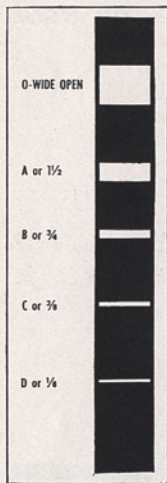


Figure 2

on the ground glass indicates the sharpness of the negative. The mirror automatically lifts away just before exposure, so that light from the lens passes directly to the film to form the image.

2. The **focal-plane shutter** is a curtain (Figure 2) of special cloth containing five slits of different widths. It is carried on an **upper roller** and winds down across the film and onto a **lower roller** when released by movement of the mirror. (Its action may be observed with the film holder removed from the back of the camera.) The time of exposure is governed by two variables:

- a. the **width of the slit** (or curtain aperture), and
- b. the **speed of the curtain** (controlled by tension of the lower roller).

The **shutter-speed plate** (Figure 6, 6a, 6b) shows the various exposures resulting from different combinations of **slit and tension**.

Directions for the shutter controls will be found on pages 9,10,11,12 and 13.

3. **Sensitized materials** to receive the image are carried in a suitable holder (Figure 8) behind the curtain. Several types of accessories are available for this purpose: **sheet film holders, plate holders, film-pack adapters**

and **sheet film magazines** for all sizes of the Graflex; and for certain sizes only there are **plate magazines** and **roll holders**. Instructions for using the last three types of accessories are supplied with them.

A fine camera is primarily an instrument rather than a machine, and the reputation which Graflex products have won for sturdiness and continued functioning under adverse conditions should in no sense be an invitation to abuse them. To insure the long and trouble-free life of which your camera is capable, study and follow these directions as you handle it for the first time. Above all, do not twist any knobs or push any buttons on this camera until you know what this pamphlet tells about them. Do not lend your camera to anyone not familiar with it without instructing him in how to use it. If you lose this book, write us for another.

Since the manner of operating all Graflex cameras is the same in all important details, this manual applies equally well to all current and most older models. Minor points of variation between the different models



will be clearly emphasized and explained. These differences relate principally to 1. opening and closing the camera, 2. interchanging lenses, and 3. focusing controls.

The National Graflex, RB Series C, and the 5 x 7 RB Home Portrait Graflex and some of the earlier folding cameras, are covered by their own special manuals.

## OPENING THE CAMERA AND FOCUSING

*Series B • R.B. Series B • R.B. Series D • R.B. Super D  
R.B. Tele • Auto (Stationary Back) • Auto Jr. • R.B. Jr.*

The **top** is first opened (Figure 3) by releasing the **spring catch L** at the upper front of the camera, pulling the top up and back until the **focusing hood** is fully extended, and straightening the two **side braces** until they lock in position.

Then open the front of the camera by turning the knurled **focusing control S** forward (clockwise); this moves the lens carrier and lens forward and automatically releases the front door so that it snaps up.

The opened door of the R.B. Super D and Series D serves well as a lens-shade by virtue of the side flaps.

### *R.B. Auto Graflex*

Open the top as directed above.

This model has an extra-long bed, which accommodates the additional bellows extension and also serves as the front door. Release it by pressing on the **bed-release button** under the leather at the top of the extreme front of

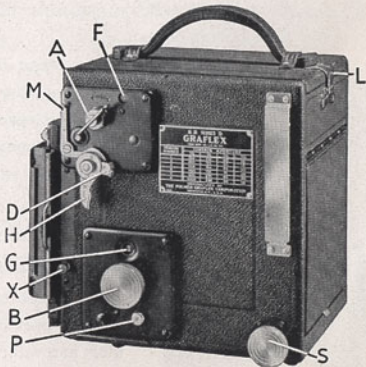


Figure 3

the camera, and press the bed firmly down until the **bed braces** snap into position (Figure 10).

There are two **focusing controls** for the R.B. Auto Graflex (Figure 10, Page 24): one at the lower right front corner of the body, is used for normal work; the other, on the right side of the bed near the front, comes into use when the bellows are given considerable extension—as when focusing at very close range.

Further data on close-up work with the R.B. Auto Graflex will be found on pages 24 and 25, and other specific information on page 9.

## CLOSING THE CAMERA

Rack the lens all the way back into the camera and close the front door or bed, making sure that it snaps securely.

To close the top, fold the braces and push the top down, folding the focusing hood carefully back into its original position. Make sure the top is securely held by the snap-catch at the front.

**Important:** After closing the camera remove all tension from the shutter mechanism by releasing both the aperture and the tension controls to their lowest settings, and raise the mirror by pressing release lever. (See bottom of page 9).

**Note:** Some large lenses when racked back may not permit the mirror to rise fully. In such an instance, release the mirror before racking the lens into the camera. This will prevent the mirror from accidentally striking the lens mount.



## HOLDING THE GRAFLEX—

### *All Models*

The shape of the Graflex and the position of its controls permit it to be held and operated comfortably and without strain. The fact that an erect image

Figure 4

is visible in the ground glass, right up to the instant of exposure, further simplifies the handling of the camera.

Rest the camera in both hands, with the fingers under the corresponding front corners of the body (Figure 4). The thumb of the left hand falls naturally on the release lever, while the right thumb and the forefinger are in position to grasp the focusing knob **S**. To steady the camera, hold it firmly against the chest. To re-set the controls after exposure, tilt the camera to the left so it rests on the left hand and fore-arm.

## FOCUSING—*General*

(See below for Super D with automatic diaphragm).

The Mirror must be set for focusing; see page 11. Information on the ground glass is on Page 14.

Moving the lens away from the film focuses on close subjects; moving it toward the film focuses on more distant subjects.

Focusing will be greatly facilitated by a large diaphragm opening. This gives a bright image, and in addition the shallow depth of field will make critical focusing on a specific point or plane much easier and more precise. *Don't forget to set the diaphragm before exposing!*

## Focusing with Automatic Diaphragm—*Super D*

The automatic diaphragm, as used in the Super D Graflex, permits you to focus with the lens wide open and then automatically stops itself down to a pre-selected aperture while the mirror is rising before exposure. This facilitates focusing with a filter in place, with poor light, with a very bright light that blinds the eyes, and whenever a critical focus is desirable. Since the depth of field (see page .19) is shallower with the lens wide-open than when it is stopped down, the plane of sharp focus is more clearly defined and accurate focusing is more rapid and certain.

To set the automatic diaphragm, pull out the **stop-pin** (left in Figure 5) and move it until its pointer is



Figure 5



opposite the aperture required by light conditions and shutter speed; release the pin so that it engages the corresponding hole and remains in position. Then set the mirror, slit and tension as directed on page 10. Lastly, move the **aperture lever** to the right (counter-clockwise) until it engages and is retained by the **catch**. (Figure 5 shows this position.) When the **mirror-release** is depressed, a connecting mechanism within the camera lifts the catch so that the spring mechanism in the lens mount closes down the diaphragm, even to the smallest stop, before the curtain begins to open.

Note that for very critical exposure control, half-stop settings are available between  $f/5.6$  and  $f/16$ . If it should be desirable to stop down the diaphragm before exposure, slowly depress the mirror release part-way until the diaphragm is heard to close; further pressure will release the mirror and curtain. Naturally you need not set the diaphragm full-open before exposure if you prefer not to for certain special conditions.

## INTERCHANGING LENSES

### *Series B • R.B. Series B • Auto Jr. • R.B. Jr.*

The lenses of these Graflex cameras thread directly into fixed lensboards, and are removed by simply turning the entire lens barrel counter-clockwise. Be sure to grasp the barrel itself, near the lensboard, so that you will not accidentally loosen the front cell of the lens. If the lens does not free easily, slightly loosen the four small screws in the face of the lensboard.

Certain telephoto lenses are suitable for use with these cameras. They may require an adapter or intermediate collar threading into the opening in the lensboard. Focusing and exposing with these lenses is carried out in the normal way.

### *R.B. Super D • R.B. Series D • R.B. Tele Auto (Stationary Back)*

Lenses of these models are fitted to removable lensboards. They are removed by pushing lens and lensboard straight up, against a hidden



spring, until the bottom of the lensboard is clear of the lower retaining strip; it may then be swung out and down, free of the camera. If the lens has a very large diameter it may be necessary to unscrew it from the lensboard before the lensboard can be removed from the camera.

To replace the lens and lensboard, reverse the above procedure—with the **bevelled** edge of the lensboard at the **top**, so that it fits into the slot with the hidden spring. Be sure to pull the lensboard **all of the way down** behind the lower retaining strip.

Lenses in barrel mount and in automatic diaphragm mount are fully interchangeable in the Super D Graflex, without special adjustments. The automatic diaphragm should be set before it is fitted into the camera.

### *R.B. Auto Graflex*

Lenses of the R.B. Auto Graflex are fitted to removable lensboards, held in place by a **slide-lock** and **retaining strip** similar to those used on the back of the camera to retain the film and plate holders. To remove lens and lensboard, move the slide-lock to the left and up until the top of the lensboard is free; swing the top of the lensboard out and lift the bottom out from behind the lower retaining strip.

To replace a lensboard, reverse the above procedure—making sure that the bevelled edge of the lensboard is at the bottom.

## THE FOCAL-PLANE SHUTTER—*All Models*

This type of shutter is so-called because it operates close to the focal plane of the lens (the location of the film). Its principal advantages are: 1 ready interchangeability of lenses, 2 high efficiency, 3 ability to produce extremely short exposures, and 4 long, trouble-free life.

The controls of the shutter and mirror, shown in Figure 3, are located at the right rear of the camera. The **release lever**, which is depressed to make an instantaneous exposure, is actually the **mirror release** and is located at the front of the left side conveniently under the left thumb.

On many models each of the shutter and mirror controls has an

identifying letter stamped into it. These letters are the same on all models of the Graflex (except the National Graflex which has its own manual) although the form of a particular lever or key may differ somewhat from one camera to another. The letters used below refer to Figure 3.

The various combinations of the tensions and four apertures provide a wide range of speeds (shutter settings), up to 1/1000. Fig. 6, 6A).

Before actually using the camera, set it on a table and follow the description below by manipulating each control as it is mentioned.

## Setting the Curtain Aperture (slit)

The **mirror-setting lever H**, just under the **aperture control A**, (Figure 3) is extremely important because the curtain cannot move (except when set for Time) until the mirror has been set by pressing this lever down and back (toward the rear of the camera). The curtain aperture (slit) to be used for an exposure is set by the **aperture control A**; and the tension (which determines the speed with which the curtain moves) is set by **tension control B**. Windows **F** and **G**, next to their respective controls, show the settings of these adjustments. Turning **A** counter-clockwise (clockwise in the Auto Jr.) with the arrow, winds to narrower slits; moving **curtain-release lever M** toward the back of the camera allows the curtain to unwind to wider slits.

The figures on the scale showing in **F** indicate the aperture that will next pass across the film when the curtain is released. When set on **T** (for Time Exposure), releasing the shutter places the slit **O** in front of the film, exposing the entire film at the same time. Operating the **curtain-release M** a second time closes the curtain.

In the  $2\frac{1}{4} \times 3\frac{1}{4}$  *R.B. Series B*, it is necessary to wind **A** two clicks between settings; the number *exactly* centered in **F** indicates the aperture for which it is set.

The curtain is closed when any number except **O** (Open) is centered in **F**.

TENSION NUMBER	CURTAIN APERTURE			
	A	B	C	D
1	10	70	200	300
2	15	80	240	600
3	20	90	280	700
4	30	100	320	800
5	30	125	360	900
6	40	150	400	1000

Figure 6—Shutter Speed Plate  
—Recent Models

## Setting the Tension

**Tension control B** is turned clockwise (counter-clockwise in the Auto Jr. and R.B. Jr.) to set to higher tensions, and is released for lower tensions by pushing up and down on **tension release P** immediately below it. In all models except the new Super D GRAFLEX Cameras with the simplified shutter (See fig. 6B), the tension control is divided into six different settings. In the newer cameras, there are only two tension settings L (low) and H (high). Intermediate positions of the tension control knob have not been calibrated for shutter speeds produced thereby, since the difference in shutter speeds now calibrated is the same or less than the difference of one full stop opening of the diaphragm which is marked in half-stop positions to permit critical control of exposure.

**Mirror-setting lever H** (Figure 3) contains a sliding bar\* with an **I** on one end and a **T** on the other. Make sure the **I** shows when you wish to make any instantaneous exposure. This bar cannot be changed unless the mirror is down; (full information about its use will be found on page 12 in the section headed "Making a Time Exposure").

Lever **H** is rotated clockwise to move the mirror into focusing position; when the mirror is released by pressure on **mirror release** (on the left front of the camera), the resulting rotation of **H** causes the lug on the end of the **I-T** bar (or disc) to trip **curtain-release lever M**; this releases the curtain and makes the exposure.

## Making an Instantaneous Exposure

1. Set the mirror by pushing back on lever **H**.
2. Determine the exposure time; this is covered on page 20 of this manual. Having decided on (for example) 1/125, find

\*Some cameras have a disc. When the letter **I** is opposite the notch or line in the top of lever **H**, it is set for an instantaneous exposure. Depressing this disc and revolving in a clockwise direction will set the camera for Time as indicated when **T** is opposite the notch.

R.B. GRAFLEX-SERIES D CURTAIN APERTURE				
TENSION NUMBER	1/6	1/8	1/4	1/2
1	350	110	40	10
2	440	135	50	15
3	550	160	65	20
4	680	195	75	25
5	825	235	80	30
6	1000	295	90	35

THE FOLMER GRAFLEX CORPORATION  
ROCHESTER, N. Y., U.S.A.

Figure 6A—Shutter Speed Plate  
—Earlier Models

R.B. Super D GRAFLEX				
TRADE MARKS REG. U.S. PAT. OFF.				
TENSION	CURTAIN APERTURE			
	A	B	C	D
Low	30	125	300	800
High	60	200	400	1000

MFG. BY GRAFLEX INC.  
ROCHESTER & NEW YORK, U.S.A.

Figure 6B—Shutter Speed Plate of  
Super D Model, Serial numbers  
414785 and higher.



the correct aperture and tension on the **shutter speed plate** (Fig. 6). Locate 1/125 on the plate; reading straight up, you will find aperture **B**, reading straight to the left you will find tension **No. 5** or **L**.

3. Set the tension by rotating **B** or releasing it by repeatedly lifting up on button **P**, until the desired number or letter (**5** or **L** in our example) appears in window **G**.
4. Set the curtain aperture by rotating **A** or releasing it with **M** until the desired number (**B** in our example) appears in window **F**. The **aperture control A** will not turn unless the mirror is down in focusing position.
5. Remove the slide from the film holder.
6. Compose and focus on the ground glass.
7. See that the diaphragm is set correctly.
8. Press slowly and steadily on release lever with the left thumb. This permits the mirror to rise clear of the field of the lens, its motion rotating lever **M** until it releases the curtain. The slit in the curtain then passes across the film and the exposure is made.
9. Re-set the mirror by pressing back on **H**.
10. Turn key **A** until **B** again appears in window **F**. Change the film. (Replace the slide if the film carrier is to be removed from the camera.) Open the automatic diaphragm of the Super D GRAFLEX Model to facilitate critical focusing. You are now ready to make another picture with the same exposure.

Note: A "drop-curtain" exposure of about 1/5 second is obtained with the curtain at **O** and the tension at **6** or **H**.

## Making a Time Exposure

The procedure for a Time exposure is somewhat different, because the mirror and curtain are released separately.

1. Set the **mirror** by pressing on **H**.
2. Move the **I-T** bar\* all the way to the right until the **I** is

*\*If your camera has a disc instead of a bar, see footnote on page 11*

covered and the **T** is visible; this disconnects the mirror from the shutter.

3. Set the **aperture** at **T**.
4. Set the **tension** at 3 or higher, (**H** on Super D).
5. Make sure the camera is firmly supported, as on a Crown Tripod or a steady table. Compose and focus on the ground glass.
6. See that the diaphragm is set correctly.
7. Raise the mirror by pressure on **release lever**.
8. Open the curtain by a steady, gentle pressure on the **curtain-release M**.
9. At the end of the required exposure time, close the curtain by another steady, gentle pressure on **M**.
10. If you are going to make another Time exposure of the same subject with the same composition and focus, leave the mirror up and insert the slide in the holder before re-winding the curtain to **T**. Or you can re-set the mirror, wind the shutter, change the film, check the focus and release the mirror.
11. If you are not going to make another Time exposure immediately, replace the slide, set the mirror by pressure on **H**, and re-set the **I-T** bar so that the **I** is showing and the camera is ready for an instantaneous exposure.

## THE CAMERA BACK—*All Models*

### Revolving Back

Most models of the Graflex are equipped with a revolving back. This is an arrangement permitting the rotation of the film or plate so that its long dimension may be either vertical or horizontal, to make possible vertical or horizontal format of the picture without turning the camera on its side. To revolve the back, push in on the **revolving-back release-button X** (Figures 3 and 7) and revolve the extreme back of the camera. Make sure that the catch clicks to hold the back in the proper position; however, if the back is to be revolved



Figure 7

only partially, this click will not make itself evident. The back is light-tight and may be turned with the film holder in place and the slide withdrawn.

## The Ground Glass

The viewing area of the ground glass is shaped somewhat like a cross; when the back is vertical use the rectangular area running fore-and-aft for framing the picture, and when the back is horizontal use the cross-ways portion. The two sets of boundary lines show the limits of the field in each direction, and the center cross-lines help in keeping the camera horizontal and in locating the center of the field.

## The Focusing Panel

When it is desirable to observe the image on a ground glass at the back of the camera, for instance when the camera is placed on a high support, the accessory **Graflex Focusing Panel** will be required. It may be fitted to the camera by the slide locks which hold the film and plate attachments and are described in the following paragraph. The accessory focusing panel is provided with side shields and a metal door which can be released by pressing *down* on the small latch directly beneath the door. When raised, this door permits direct ground-glass focusing and composing of the image produced by the lens. **Note:** Make sure that the focal-plane shutter is set at **O**, the **I-T bar** at **T**, and the mirror raised;

## Film and Plate Attachments

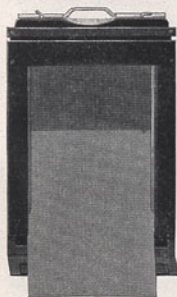


Figure 8

The various types of film and plate holders attach directly to the back of the camera (without adapters) by means of a slotted **slide-lock** and a fixed **retaining strip** (Figure 7). Note that the newer models have slide-locks at both top and bottom. Both must be moved to the left to open and allow fitting or removal of a holder or focusing panel. Moving both slide-locks to the right will lock the attachment in place on the camera. In those models with a single slide-lock at the top, move it to the right to open. Then place one edge of a holder or attachment under the retaining strip and press the other edge firmly against the camera body below the slide-lock; lastly lock the holder in position by moving the slide-lock down as far as it will go.



## Loading Holders

If you are unable to secure an old film with which to practice in daylight, use a sheet of new film.

**Sheet film holders** should be loaded in *complete* darkness—preferably in a photographic darkroom. Place the holders on a *clean* workbench and withdraw the slides, laying them to one side well within reach. As the box of film is opened, note that the sheets are interleaved with black paper.

To find the emulsion side of a piece of sheet film in the dark, note the position of the notches cut into one of its shorter edges. The emulsion side will be facing you when the unnotched short side of the film is nearest you and the notches are in the upper right-hand corner. Always handle the film by its edges and never touch the front (emulsion) surface.

Open the wood **flap** at the end of the holder, and slide in the film. (Figure 8). Make sure that the edges are beneath the **side rails**. The film should be pushed home so that it is under the rail at the other end of the holder. Close the wood flap and replace the slide in the holder, with the raised dots on the outside to show that this side of the holder contains unexposed film. (If the slide does not fit fully into the slot in the end of the flap, the film has not been pushed under the rail at the closed end of the septum). Turn the small brass **slide-hook** over the end to prevent accidental withdrawal of the slide. When slides are replaced after exposure, have the raised dots inside to show that the film has been exposed.

**Plate holders** are loaded in much the same way as film holders, except that there are no side rails and the end of the plate is slid in under a projection at the slide-handle end of the holder. The plate is held in place when the wood flap is closed and slide inserted.

**Film packs** can be loaded in daylight, but strong or direct light should be avoided. When handling a pack always grasp it by only the sides, since the films will be fogged if the protective black paper is depressed. Release both catches and swing the back of the adapter open. Carefully insert the closed end of the film pack under the light-break at

the hinge. Be sure that the opening of the pack rests next to the slide of the adapter. With the paper tabs held straight out, close the back. Before making the first exposure, pull the first tab (marked **O**) straight out from the pack until a resistance is felt; then bring it around toward the back of the camera and tear it off with a smooth, even motion. After the first exposure tear off tab **1** in the same way, and so on after each exposure until the last tab (**12**) has been torn off. (Pulling the tabs moves exposed film from the open front of the pack to the back.) After the last tab has been pulled the exposed pack is somewhat self-protected, and may be removed from the adapter in subdued light to be wrapped in the original paper and box. *Handle the film pack only by its edges.*

**Magazines** holding twelve sheets of film in individual septums for exposure and development at will, are covered by a special instruction manual which accompanies each magazine. A special manual is also available for **roll holder** attachments which have been supplied for **GRAFLEX** Cameras.

## LENSES—*All Models*

The lenses supplied by Graflex with Graflex cameras are selected as the best available for the requirements of both black-and-white and color photography.

Most lenses on Graflex cameras are in barrel mount, (either *normal* or *sunk*), although certain models will accommodate lenses in shutters. The RB Super D Graflex also accepts lenses in automatic diaphragm mount. (See page 7.)



### Lens Aperture

Lenses (Figure 9) are normally equipped with an **iris diaphragm** between the cells, which forms a many-sided opening whose diameter is altered by the rotation of a ring outside the lens. The diaphragm controls **1** the amount of light passed by the lens, and **2** the depth of field.

The size of the opening of the dia-

Figure 9

phragm is indicated by a series of numbers associated with the **diaphragm-control ring**; these are the **f/ numbers**, expressing the relationship between the *focal length* of the lens and its *effective aperture*—(not the diameter of the diaphragm opening). The *rated speed* of a lens is its maximum relative aperture, as indicated by the f/ number engraved on the front cell—usually as a part of the name of the lens. Equal f/ numbers have substantially equivalent light-transmitting values on all lenses regardless of focal length. The larger openings, passing larger quantities of light, are associated with smaller numbers such as f/2.9, f/3.5, or f/4.5. The smaller openings, passing less light, are represented by larger numbers like f/22 or f/32. Full information about the use of the diaphragm will be found under the heading "Correct Exposure" on page 20.

### Focal Length

The **focal length** of a lens is the distance, when it is focused on infinity (very distant objects), from the plane in which the image is formed to the rear nodal plane of the lens (in standard lenses, generally located near the diaphragm). Like the maximum relative aperture (f/ number), the focal length is usually engraved on the lens cell. It may be expressed in inches, millimeters or centimeters.

The size of image given by a lens at any particular working distance varies with the focal length: for instance, if a 3-inch lens gives a 1-inch high image of an object, a 6-inch lens in the same position will give an image 2 inches high of the same object.

The "normal" lens for a given size of negative has a focal length approximately equal to the diagonal of the negative. The Revolving Back Graflex and other reflex cameras require focal lengths slightly greater than "normal" to allow clearance for the mirror when it swings up.

The greater the focal length the farther the camera can be placed from a subject for obtaining a given image size, with improved perspective.

The greater the focal length of a lens, the less its **depth of field** for a given working distance and aperture. This is discussed fully under the heading "Depth of Field" on page 19.



## Long-Focus Lenses and Telephotos

When it is not possible to approach close enough to a distant or semi-distant subject, as in sports photography, long focal-lengths are desirable to give as large an image as possible on the negative. Telephoto lenses are long-focus lenses specially designed so as not to require as great bellows extension as ordinary lenses of the same equivalent focus, thus making the camera more compact and usable. Telephoto lenses can be used with most models of the Graflex; full information is under "Inter-changing Lenses" on page 8.

## Wide-Angle Lenses

These lenses have focal lengths materially shorter than "normal" for the negative they are designed to cover, special optical design making possible a sharp image over the entire area of the negative. *They cannot be used in Graflex, or other reflex, cameras* because they do not provide clearance for the swing of the mirror.

## COATED LENSES

The coating of lenses is one of the most recent accomplishments in the optical industry. A coated lens will have a brownish-purple color on the surface. This color is similar to the tarnish or iridescent color that was previously considered detrimental in lenses. The process of coating deposits a metallic salt, such as magnesium fluoride, on the surface of the lens in an extremely high vacuum.

The coating of lenses is done only on the air glass surfaces and not on the cemented surfaces. The advantages of coating photographic lenses are an increase in transmitted light by a reduction in light loss caused by internal reflections, a definite increase in brilliance or contrast of the image and the elimination of flare spots due to multiple reflections within the lens. Every surface of a lens that is coated will increase the light transmission. However, with most standard lenses, this increase in light transmission will not be noticeable due to the exposure latitude of most of the films currently available. The added brilliance due to the coating of the lens surfaces should be noticeable and should result in finer photographs.

The coating which is now being applied to lens surfaces is almost as hard as the average optical glass. While no special precautions are necessary for cleaning the surfaces of coated lenses, they should be handled as carefully as all fine lenses. All surface grit and dust should

first be removed with a soft camel's hair brush before the lens is cleaned with a fine lens tissue or a soft cloth such as a well-laundered linen handkerchief. Do not apply pressure on the cloth. Simply breathe on the surface of the lens and wipe gently with easy circular motions. If a lens cleaning fluid (only those specifically recommended by lens manufacturers) is to be used, do not apply it directly on the lens surface. Instead place a drop or two on the lens tissue or cloth and wipe the lens with the moistened material.

## DEPTH OF FIELD

Although we may focus most precisely on a certain portion of an object, we all know that things slightly nearer to the camera as well as some slightly farther away may also appear sharp in the final print. The field of sharp focus extends farther behind the object than in front. This range of distances within which all objects appear equally sharp is called the **depth of field**.

As in the case of stopping motion to be considered in the following section, our acceptance of sharpness will depend upon the nature of the print and how it is viewed; and the sharpness to be demanded of a negative for making such prints must depend upon the amount of enlargement contemplated. Depth of Field, therefore, is not a precise physical quantity which can be measured. Most lens manufacturers publish tables under the heading "depth of field," or less correctly "depth of focus," which some photographers find useful. The great majority of camera users, however, find observation of the image on the ground glass and the following easily-remembered facts to be enough of a guide for all practical purposes.

1. *The greater the distance to the object focused on, the greater the depth of field for a given focal length and relative aperture.*
2. *The greater the focal length of the lens, the less the depth of field at a given relative aperture and distance.*
3. *The greater the lens aperture (the smaller the  $f$ / number), the less the depth of field for a given focal length and distance.*
4. *The sharp field is deeper behind the object than in front of it.*

If you want the greatest possible amount of material to appear sharp in your picture, stop the lens down as far as you can without requiring an exposure time so long that movement becomes objectionable. If, on the other hand, you wish to minimize the background or nearer objects by purposely throwing them out of focus, open up the lens to one of its

larger apertures. If you want the maximum sharpness at the precise point on which you focus without regard to objects nearer or farther away, choose a lens aperture approximately half way between the greatest and the smallest which your lens can give.

When using the automatic diaphragm of the Super D Graflex, bear in mind that the depth of field will be greater when the lens has stopped itself down than when you focus wide-open.

## CORRECT EXPOSURE—*All Models*

While the final goal of most photography must be admitted to be a satisfactory print, the *first* goal of the camera user is a negative in which at least the main subject of interest is sharply defined and of a contrast and density which will permit making a print with good tone values. These two factors will depend upon the brightness range of the subject, the speed of the film, the processing subsequently given the film, and upon the lens and the shutter settings in relation to these quantities.

It is difficult, if not impossible to give specific directions for setting up a camera for the making of every type of picture. However, for your guidance in estimating exposures you will find the tables supplied by film manufacturers to be very satisfactory for the majority of average situations. Such tables are usually included with film packs and rolls, and are generally available for sheet film and other materials on request to the manufacturers and their Dealers.

Since any exposure guide, no matter how complete, can represent only an approximation of the many various light conditions you will encounter, we strongly urge that you eliminate a good deal of the complication involved in the determination of the exposure by using a good exposure meter. The price of one of the better photo-electric models will be repaid many-fold in good negatives and general satisfaction. In any event, be sure to keep a small card on which to jot down a word or two about each picture: character of the subject, prevailing light conditions, shutter speed, diaphragm opening, and meter readings. These data will be of great assistance in evaluating your resulting negatives, and will also assist you to broaden out into the use of other emulsions, diaphragm openings and shutter speeds.

But the exposure meter or exposure guide will only go so far as to present you with a rather wide choice of lens-aperture and shutter-speed combinations, telling you that if you choose  $f/11$  (for example) then you must set the shutter for 25 ( $1/25$ ); or that if you wish to use  $1/100$  in



order to stop some fast motion then you must set the lens aperture to  $f/5.6$ .

"Increasing the shutter speed" means that a shorter exposure is given—as, for example, in changing from  $1/50$  to  $1/100$ . In other words, the shutter passes light for a shorter length of time.

"Increasing the Exposure" means that a slower shutter speed is used, as in going from  $1/100$  to  $1/50$ .

"A larger stop" or "opening up the lens" means that the actual diameter of the aperture of the lens is increased, and hence more light is passed by the lens in a given length of time. The smaller  $f/$  numbers indicate larger apertures— $f/8$  being larger than  $f/16$ ,  $f/3.5$  larger than  $f/5.6$ , etc.

The relation between these combinations of diaphragm opening and shutter speed is really very simple, and knowing one of them is sufficient to give you any other without even a pencil. The rule is simply this: every time you open up the lens one full stop (to the next  $f/$  number \*), double the shutter speed; and vice-versa.

The choice of a combination of shutter speed and diaphragm opening will be determined by the type of subject. If the subject is moving take the lowest shutter speed necessary to stop its motion and set the diaphragm accordingly; if the subject is static use the diaphragm opening giving the required depth of field and set the shutter speed for that value.

Suppose, for example, that you determine from your meter or the exposure tables that the correct exposure would be  $1/50$  at  $f/16$ . But your subject is going to move and you have estimated that  $1/200$ th will be needed to stop it on the negative. You know that this will require opening up the lens so you proceed to do so, counting as you go from stop to stop: starting at the next larger will be  $f/11$ , for which you double the speed—(going to  $1/100$ th); the following stop is  $f/8$ , for which you double the speed again—(going to  $1/200$ ). And there you have it:  **$f/8$**  at  $1/200$  (on earlier models use  **$1/195$**  which is the nearest speed produced by the shutter). The exposure meter dials will be found to bear the same relation between the combinations offered.

Like so many so-called "rules" the above one also has an exception, which applies to only some lenses at maximum aperture. Going from  $f/32$  to progressively larger apertures, each calling for a doubling of shutter speed as we go down the list, the ideal diaphragm scale would be marked:

$f/32, 22, 16, 11, 8, 5.6, 4, 2.8, 2, 1.4, 1$

\*Except from  $f/5.6$  to  $f/4.5$  or from  $f/4.5$  to  $f/3.5$ . The difference here may be considered as being 50%, or  $\frac{1}{2}$  stop.

The lens on your Graflex probably has just these same stops indicated from  $f/32$  to  $f/5.6$ . But if its maximum aperture is  $f/4.5$  that figure will follow the  $f/5.6$  without being twice as fast; it is about 50% faster and would therefore call for a 50% increase in shutter speed instead of the 100% set by our rule. A similar caution must be observed if you have an  $f/3.5$  objective, as it will be marked at  $f/4.5$  and  $f/3.5$  even though the 2-to-1 exposure factor does not lie between these two apertures. Lenses in automatic diaphragm are marked with half stop positions to facilitate critical control of exposure.

Any of these combinations which an exposure meter offers you will give the same density of negative; but the over-all sharpness of those negatives and the amount of subject that will appear to be in good focus will vary with the exact combination you choose. And the choice which the photographer must make will be a compromise between the need for stopping motion (calling for the higher shutter speeds and the larger lens apertures) and the desire to have the greatest amount of material in sharp focus (calling for smaller lens apertures and slower speeds).

## STOPPING MOTION—*All Models*

If the subject you intend to photograph is moving, its image on the plate will likewise move. It will move some during even  $1/1000$ th second, although only about one-tenth as far as it will during  $1/100$ th second. All the photographer can hope to do is to give a short enough exposure so that the motion of the image on his film will not be objectionable. And just what constitutes "objectionable" depends both on the observer and upon the use to which the negative is to be put. A negative which is to be enlarged 10 times or to be printed in a magazine must be sharper than if it were to be reproduced in its original size. And a print which is apt to be examined through a reading glass must naturally be sharper than one to be seen from a distance only, as a highway billboard.

Not knowing precisely how his negative may be used, the average photographer must aim at "average acceptability," and it is on this basis that the following table has been compiled. It allows the photographer to take into account the four factors which are present at the time of his exposure: Namely, the focal length of his lens, the distance he will be from the subject when he releases the shutter, the velocity with which the subject will be moving at the instant of exposure, and the direction of its motion relative to the direction in which he is pointing his camera.

Suggested exposures to stop motion at right angles to the camera when the subject moves 10 miles per hour

		APPROXIMATE FOCAL LENGTHS IN INCHES				
		4	5	6	7	8
DISTANCE FROM SUBJECT IN FEET	12	1/500	1/600	1/700	1/800	1/1000
	25	1/250	1/300	1/350	1/400	1/500
	50	1/125	1/150	1/170	1/200	1/250
	100	1/70	1/80	1/90	1/100	1/125

*These speeds are only approximate, and have been "rounded off" to give numbers easy to multiply and divide. The need of greater accuracy is doubtful in view of the uncertain speed of the object to be photographed.*

The above table applies to a subject moving 10 miles per hour at right-angles to the camera. In all probability your subject will be doing something different. If so, modify the shutter speed called for in the above table by the following rules:

*\*Double the speed of the shutter for double the velocity of the subject.*

*\*\*Half the shutter speed for half the velocity.*

*\*Double the shutter speed for half the distance to the subject.*

*\*\*Half the shutter speed for double the distance.*

*\*Double the shutter speed for double the focal length.*

*\*\*Half the shutter speed for half the focal length.*

*Use one-third the shutter speed if the subject is coming directly toward you or going directly away from you.*

*Use two-thirds the shutter speed if it is coming or going at 45 degrees.*

**When in doubt, use the next higher speed.**

*—1/100 instead of 1/50, for example.*

*\*\*—1/50 instead of 1/100, for example.*



## SPECIAL INSTRUCTIONS FOR THE *R.B. Auto* GRAFLEX

### Rising Front and Drop-Bed

In some instances, you may find it necessary or helpful to raise the lens slightly to bring the subject into better position on the ground glass, or to prevent tilting the camera up and causing the convergence of vertical parallel lines when photographing a high building. This is accomplished by loosening the **rising-front knobs** on each side of the front standard, shifting it vertically, and locking it in the new position by the rising-front knobs. (See Figure 10.)

The **drop-bed** similarly takes the place of pointing the camera down in photographing objects below the level of the camera. To drop the bed, rack out the track until it is entirely on the front bed and then depress the side braces; this frees the bed so that it falls into the dropped position. (This will be useful principally for "table top" set-ups or with long focal-length lenses).

### Double-Extension Bellows (for Close-up Photography)

When using the camera for close-up photography, the lens is placed at a greater distance than normal from the focal plane (film position). (See page 7). This will necessitate a change in the exposure, since

the  $f/$  values engraved on the lens are based on a relationship existing only when the lens is at the infinity position. For close-up photography, we recommend that your exposures be determined in accordance with the following table. The lens-to-film distance (bellows draw) can be determined approximately by meas-

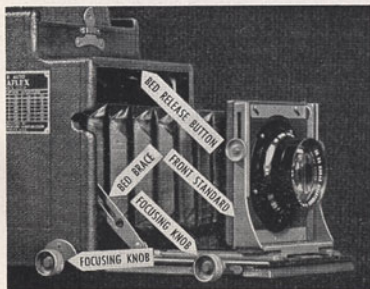


Figure 10

uring from the diaphragm-control ring of the lens back to the plane occupied by the film (the ground glass).

Reproduction Ratio (Image size to Object size)	Bellows Draw	Exposure Factor*
1:8	1.125 <i>f</i>	1.265*
1:4	1.25 <i>f</i>	1.56*
1:2	1.5 <i>f</i>	2.25*
1:1.5	1.75 <i>f</i>	3.06*
1:1	2 <i>f</i>	4*

*f* = focal length

For black-and-white photography with standard films, you may find that the latitude of the film will compensate for much of the change in exposure so that no allowance for extension will be required unless copying larger than half-size (1:2). However, for color photography, we would recommend that you follow this table very closely because of the limited latitude of color materials.

## FLASH PHOTOGRAPHY—*Super D*

### Attaching the Flashing Unit

A GRAFLEX Flashing Unit consists of a battery case, reflector and connecting cord, together with a mounting plate or bracket to be attached to the camera. The mounting plate or bracket is generally attached to the right front corner of the camera body above the focusing knob. Attach the battery case to its mounting plate. With the early GRAFLEX battery case, the connecting cord is attached to the series outlet by unscrewing the push button switch. With the newer GRAFLITE, set the circuit controller at "1" and insert the connecting cord in the outlet marked "SHUTTER". Attach the other end of the connecting cord to the camera's synchronizer socket. In the early Super D Models, this will be found in approximately the center of the left side of the camera body, but in the newer models it is an integral part of the shutter plate at the right side of the camera.

### Open Flash all Super D Models

The GRAFLEX Camera provides a drop curtain setting providing a speed of approximately 1/5 second (see page 12). At this setting (curtain at "O" and tension at "H") a flash lamp will be fired while the shutter curtain is open. Determine the correct diaphragm opening for the flash lamp and the distance to the subject on the basis of a "Time" or "Open Flash" exposure from the table supplied by the lamp manufacturer, and set the diaphragm control of the lens accordingly. The length of

exposure will depend primarily on the duration of the flash and in the case of SM or SF lamps (gas-filled), this will be in the neighborhood of 1/200 of a second. High Speed Electronic Flash Units can also be used with the Open Flash - LOW tension setting with those Super D Models having the simplified focal plane shutter with speeds shown in Figure 6B.

### Instantaneous Flash with $3\frac{1}{4} \times 4\frac{1}{4}$ Super D

Those  $3\frac{1}{4} \times 4\frac{1}{4}$  Revolving Back Super D GRAFLEX Cameras with the synchronizer socket on the shutter plate on the right side of the camera have the necessary special curtain and mechanism to allow the firing of long peak flash lamps (G-E 31 and Wabash 2A lamps), in synchronization with the following camera settings:

1/1000 (D-High) back in horizontal or vertical position.

1/400 (C-High) back in horizontal or vertical position.

1/200 (B-High) back in horizontal or vertical position.

The B, C and D curtain apertures are marked in black as a reminder that they may be used for synchronization. Do not attempt to synchronize with LOW tension with the B, C or D apertures, or with the A aperture at either HIGH or LOW tension. This aperture is marked in red as a reminder. To prevent accidental firing of the flash lamp, be sure to disconnect the cord or remove the lamp before dropping the shutter curtain from one aperture to the next larger (viz; from D to C). The lamp will not be fired as the curtain is wound from B to D. Note: The earlier  $3\frac{1}{4} \times 4\frac{1}{4}$  Super D Models with the synchronizer socket in the side of the camera do not have the necessary special shutter or mechanism to assure synchronization at any instantaneous speeds.

### Instantaneous Flash with $4 \times 5$ Super D

In view of the larger area of the film across which the opening in the shutter curtain must travel and the larger mass of shutter curtain as well as the length of useful peak of the lamps, it is presently impractical to attempt to guarantee synchronization with a wide range of instantaneous speeds even when the long peak flash lamps are used. Because of the length of time required for the curtain opening to pass across the film and the length of useful peak of flash provided by the G-E No. 31 and Wabash No. 2A lamps, it is necessary to control carefully the location of the curtain aperture, so as to insure even exposure of all of the film. The shutter curtain of any camera will pack when wound tightly on the roller. The packing of the curtain controls the location of the curtain aperture with respect to the film at the moment the circuit to the lamp



is closed and it thus has a marked bearing upon synchronization with the useful peak of the flash during the time that the curtain aperture passes across the film. Consequently in order to allow a slight margin of safety to compensate for slight variations and tolerance in camera shutters and the flash lamps themselves, synchronization can be guaranteed only at the 1/1000 setting, (D, H) with the back of the camera horizontal and the shutter curtain packed. To accomplish this packing the tension should be set at H, the shutter should be wound to the "D" position, and allowed to drop one position (to C) by operation of the shutter release lever at the right side of the camera. NOTE: Disconnect the connecting cord to prevent pre-firing of the flash lamp as the curtain is packed. The curtain should be wound from C to D and released at least three times, following which the connecting cord may be plugged in and the exposure may be made with the expectation that the shutter will be properly packed, so as to assure synchronization.

### SUGGESTED EXPOSURE TABLE

Based on the use of G-E No. 31 Photoflash and Wabash No. 2A Superflash lamps.

Shutter Speeds	ASA Film Speed Range			
	20- 32	40- 64	80- 125	160- 250
1/200	65	85	120	170
1/400	43	60	85	120
1/1000	32	45	60	90

### Synchronization with Other Models

Because of the many variables involved, Graflex does not supply any accessory device for synchronizing Graflex focal-plane shutters. Various attachments for this purpose are on the market, and their manufacturers should be consulted for all information regarding them.

### CARE OF THE CAMERA—*All Models*

Graflex Cameras are sturdily constructed, but like all fine equipment they should be handled with consideration. To preserve the neat appearance and increase the life of your camera, the leather may be

cleaned with an occasional application of saddle soap or other good leather preservative. If kept in its carrying case when not in use it will be protected from dust, dirt and accidental blows.

The efficient life of any shutter will be greatly lengthened if all tension is released when the camera is not in use. In the case of the Graflex focal-plane shutter, operate levers **M** and **P** until the curtain and tension are run down. *Never oil a shutter.*

For best results the lens of your camera should be regularly cleaned. Use a soft, well-washed linen handkerchief, a camel's-hair brush, or lens tissue. First, blow off the dust (a camel's-hair brush or small rubber ear syringe is recommended) and then wipe without using pressure. To remove fingermarks or moisture, breathe upon the surface, and wipe. Always wipe *lightly*, and with a circular movement. Never use acids or any common household solvent for cleaning lenses. Lens cleaners supplied by lens manufacturers may be used if the instructions accompanying them are carefully followed. If the inner surfaces require cleaning, the utmost care should be observed to remove the lens elements one by one; clean and replace each before others are taken out. When replacing these elements screw them securely in place but *do not use excessive pressure.*

## The Graflex First-Surface Mirror

Graflex cameras of recent manufacture are equipped with a great aid to perfect focusing—the Graflex First-Surface Mirror. This mirror differs from ordinary mirrors in that the reflecting coating is on its *front* surface rather than on the back. This gives a much brighter image on the ground glass and eliminates the "double images" and undesirable reflections sometimes found troublesome when focusing on a strongly-highlighted subject.

The coating used for this special mirror is a highly-reflective aluminum compound which retains its brilliance in the absence of a protective coating. In order to insure maximum benefit from its use, care must be exercised in cleaning to guard against scratches from dirt or other foreign matter. Loose dust may be removed by brushing with a tuft of clean cotton saturated with water. Any marks left by the drying liquid may be removed by condensing breath moisture upon the mirror and rubbing with dry cotton. The mirror should not remain wet for any prolonged period as water is likely to leave an acid or alkaline deposit which may slowly attack it.

The under side of the ground glass can be cleaned by removing the lens and inserting through this opening a wadded, soft, lint-free cloth attached to a pencil or small stick.

The top surface of the ground glass will require cleaning more often than the mirror. Release the focusing hood by pressure on the small spring-clip holding the front of the hood frame. This will permit the hood to be folded back far enough so that a damp chamois can be wiped across the glass. *Caution: Do not remove the ground glass from the camera.*

## SERVICE

**The Graflex Service Departments** are equipped to inspect, clean, adjust and service all Graflex products, and to fit accessories and special lenses to Graflex and Speed Graphic cameras. All correspondence pertaining thereto should be addressed to the Service Department nearest you.

**The Graflex Technical Department** is anxious to help you get the most out of your Graflex-made equipment. Do not hesitate to write about any photographic problems you may have. When negatives are involved, be sure to send in the negatives with complete information concerning equipment, exposure, processing, and all other relevant data.

**The Serial Number** on your Registration Card is also stamped into the underside of the top door of your Graflex, just behind the top of the focusing hood. The numbers on the lens and the shutter-speed plate are *not* the serial number of the camera. Be sure to give the serial number of your Graflex in all correspondence concerning it.

**The Registration Card** supplied with your GRAFLEX when it left the factory should be filled out completely and accurately and returned to us promptly for the registration of your camera and lens. If you did not receive the registration card, write us today for another. For your own files, we urge you to enter herewith the serial number of your camera and identifying data pertaining to your lens.

Camera No. .... Lens No. ....

Lens Make. .... f/..... Focal Length.....